We claim:

1. A method for forming a thermal barrier coating system, the method comprising the steps of:

presenting at least one substrate;

forming a bond coat on at least a portion of at least one said substrate by a directed vapor deposition (DVD) technique;

reactively forming dispersoids in said bond coat; and

depositing a thermal-insulating layer on said bond coat.

2. The method of claim 1, wherein said dispersoids comprise an oxygen compound.

3. The method of claim 1, wherein said dispersoids comprise at least one of Oxide, Carbide, Boride, Nitride, Oxycarbide, Carbonitride, Carbonoxide, Mn, Cr, Fe, Ni, Sc, Hf, Ti, V, Zr, Al, Nb, Ta, Si, or W, or combination thereof.

4. The method of claim 1, wherein said DVD technique comprises:

said presenting of at least one of said substrate includes presenting said substrate to a chamber, wherein said chamber has an operating pressure ranging from about 0.1 to about 32,350 Pa,;

presenting at least one evaporant source to said chamber;

presenting at least one carrier gas stream to said chamber;

impinging said at least one said evaporant source with at least one energetic beam in said chamber to generate an evaporated vapor flux in a main direction respective for any of said evaporant sources impinged by said electron beam; and

deflecting at least one of said generated evaporated vapor flux by at least one of said carrier gas stream, wherein said carrier gas stream is essentially parallel to the main direction and substantially surrounds said evaporated flux, wherein said evaporated vapor flux at least partially coats at least one said substrate to form said bond coat.

5. The method of claim 4, wherein said energetic beam comprises at least one

of electron beam source, laser source, heat source, ion bombardment source, highly focused incoherent light source, microwave, radio frequency, EMF, or any energetic beam that break chemical bonds, or combination thereof.

6. The method of claim 4, further comprising:

said chamber further includes a substrate bias system capable of applying a DC or alternating potential to at least one of said substrates;

impinging said at least one of said generated vapor flux and at least one of said carrier gas stream with a working gas generated by at least one hollow cathode arc plasma activation source to ionize said at least one of said generated vapor flux and at least one of said carrier gas stream; and

attracting said ionized generated vapor flux and said carrier gas stream to a substrate surface by allowing a self-bias of said ionized gas and vapor stream or said potential to pull the ionized stream to said substrate.

7. The method of claim 6, said generated electrons from said hollow cathode source is regulated for direction through variations in the quantity of working gas passing through said hollow cathode source.

8. The process of claim 6, wherein the distance between said cathode source and said generated evaporated vapor flux is regulated for ionization of the entire generated evaporated vapor flux.

9. The method of claim 4, further comprising at least one nozzle, wherein said at least one carrier gas stream is generated from said at least one nozzle and said at least one evaporant source is disposed in said at least one nozzle, wherein said at least one said nozzle comprises:

at least one nozzle gap wherein said at least one said carrier gas flows there from; and

at least one evaporant retainer for retaining at least one said evaporant source, said evaporant retainer being at least substantially surrounded by at least one said nozzle gap.

10. The method claim 9, wherein said evaporant retainer is a crucible.

11. The method of claim 4, further comprising:

said chamber further includes a substrate bias system capable of applying a DC or alternating potential to at least one of said substrates;

impinging said at least one of said generated vapor flux and at least one of said carrier gas stream with a low energy beam to ionize said at least one of said generated vapor flux and at least one of said carrier gas stream; and

attracting said ionized generated vapor flux and said carrier gas stream to a substrate surface by allowing a self-bias of said ionized gas and vapor stream or said potential to pull the ionized stream to said substrate.

12. The method of claim 4, wherein at least one of said at least one evaporant source is a material selected from the group consisting: NiY, NiAl, PtAl, PtY, Ni, Y, Al, Pt, NiAlPt, NiYPt, NiPt, Co, Mo, Fe, Zr, Hf, Yb, and other reactive elements.

13. The method of claim 4, wherein at least one of said at least one evaporant sources is made from alloys formed of one or more of a material selected from the group consisting: NiY, NiAl, PtAl, Pty, Ni, Y, Al, Pt, NiAlPt, NiYPt, NiPt, Co, Mo, Fe, Zr, Hf, Yb, and other reactive elements.

14. A method for forming a thermal barrier coating system, the method comprising the steps of:

presenting at least one substrate;

forming a bond coat on at least a portion of at least one said substrate by a directed vapor deposition (DVD) technique;

providing nanoclusters under a pressure greater than said chamber pressure; and

injection said nanoclusters at a high velocity into the said chamber, thereby resulting in dispersoids impinged in said bond coat.

15. The method of claim 14, further comprising:

depositing a thermal-insulating layer on said bond coat.

16. A directed vapor deposition (DVD) apparatus for forming a thermal barrier coating system, the apparatus comprising:

a chamber, wherein said chamber has an operating pressure ranging from about 0.1 to about 32,350 Pa, wherein at least one substrate is presented in said chamber;

at least one evaporant source disposed in said chamber;

at least one carrier gas stream provided in said chamber; and

an energetic beam system providing at least one energetic beam, said energetic beam:

impinging at least one said evaporant source with at least one said energetic beam in said chamber to generate an evaporated vapor flux; and

deflecting at least one of said generated evaporated vapor flux by at least one of said carrier gas stream, wherein said evaporated vapor flux at least partially coats at least one of said substrates to form a bond coat and reactively forms dispersoids in said bond coat.

17. The method of claim 16, wherein said dispersoids comprise an oxygen compound.

18. The method of claim 16, wherein said dispersoids comprise at least one of Oxide, Carbide, Boride, Nitride, Oxycarbide, Carbonitride, Carbonoxide, Mn, Cr, Fe, Ni, Sc, Hf, Ti, V, Zr, Al, Nb, Ta, Si, or W, or combination thereof.

19. The apparatus of claim 16, further comprising:

said energetic beam system providing at least one energetic beam, said energetic beam:

impinging at least one of said evaporant source with at least one said energetic beam in said chamber to generate an evaporated vapor flux; and

deflecting at least one of said generated evaporated vapor flux by at least one of said carrier gas stream, wherein said evaporated vapor flux at least partially coats at least one of said substrates to form a thermal-insulating layer on said bond coat with said dispersoids therein.

20. The method of claim 16, wherein said energetic beam comprises at least one of electron beam source, electron gun source, laser source, heat source, ion bombardment source, highly focused incoherent light source, microwave, radio frequency, EMF, or any energetic beam system that breaks chemical bonds, or combination thereof.

21. The apparatus of claim 16, wherein:

said generated evaporated vapor flux is in a main direction respective for any of said evaporant sources impinged by said energetic beam; and

wherein said carrier gas stream is essentially parallel to the main direction and substantially surrounds said generated evaporated flux.

22. The apparatus of claim 16, further comprising:

a substrate bias system capable of applying a DC or alternating potential to at least one of said substrates;

at least one hollow cathode arc source generating a low voltage beam, said at least one hollow cathode arc source:

impinging said at least one of said generated vapor flux and at least one of said carrier gas stream with a working gas generated by at least one said hollow cathode arc plasma activation source to ionize said at least one of said generated vapor flux and at least one of said carrier gas stream; and

attracting said ionized generated vapor flux and said carrier gas stream to a substrate surface by allowing a self-bias of said ionized gas and vapor stream or said potential to pull the ionized stream to said substrate.

23. The apparatus of claim 22, wherein said hollow cathode arc source comprises at least one cathode orifice wherein a predetermined selection of said cathode orifices are arranged in close proximity to the gas and vapor stream; and

an anode is arranged opposite of said cathode source wherein the gas and vapor stream is there between said cathode source and said anode.

24. The apparatus of claim 16, further comprising at least one nozzle, wherein said at least one carrier gas stream is generated from said at least one nozzle and said at least one evaporant source is disposed in said at least one nozzle, wherein said at least one said nozzle comprises:

at least one nozzle gap wherein said at least one said carrier gas flows there from; and

at least one evaporant retainer for retaining at least one said evaporant source, said evaporant retainer being at least substantially surrounded by at least one said nozzle gap.

25. The apparatus of claim 24, wherein said evaporant retainer is a crucible.

26. The apparatus of claim 16, further comprising:

a substrate bias system capable of applying a DC or alternating potential to at least one of said substrates;

at least one low energy beam source for generating a low voltage beam, said at least one low energy beam source:

impinging said at least one of said generated vapor flux and at least one of said carrier gas stream with a low energy beam to ionize said at least one of said generated vapor flux and at least one of said carrier gas stream; and

attracting said ionized generated vapor flux and said carrier gas stream to a substrate surface by allowing a self-bias of said ionized gas and vapor stream or said potential to pull the ionized stream to said substrate.

27. A component having a thermal barrier coating system on a substrate thereof, the thermal barrier coating system comprising:

a bond coat deposited on at least a portion of said substrate by a directed vapor deposition (DVD) technique, wherein said bond coat comprises dispersoids in said bond coat.

28. The component of claim 27, further comprising:

a thermal-insulating layer overlying at least a portion of said bond coat.

29. The component of claim 27, wherein said component is produced by the method of claim 2.

30. The component of claim 27, wherein said component is at least one of: gas turbine engine component, diesel engine component, turbine blade, and airfoil.